Claims:

1. A process for the production of hydrogen, comprising the steps of:

(i) providing a photosynthetic microorganism having electron transfer capability through a photosynthetic "light" reaction pathway and through a respiratory electron transfer chain involving an oxidative phosphorylation pathway, and which expresses a hydrogenase, wherein regulation of the oxidative phosphorylation pathway is disrupted with the result that electron flow along the respiratory electron transfer chain toward cytochrome oxidase (complex IV) is reduced;

(ii) culturing the microorganism under microoxic and illuminated conditions; and

(iii) collecting evolved hydrogen.

2. A process as claimed in claim 1, wherein the microorganism is cultured in an acetate-containing medium.

3. A process as claimed in claim 1, wherein carbon dioxide is the carbon source.

4. A process as claimed in any one of claims 1 to 3, wherein illumination is continued for up to 120 hours.

5. A process as claimed in any one of claims 1 to 4 wherein illumination is by solar radiation.

6. A process as claimed in any one of claims 1 to 4 wherein illumination is from an artificial light source.

7. A process as claimed in either one of claims 5 or 6, wherein illumination is at a light intensity between 15 and 3100 μmol m^{-2} s^{-1}.

8. A process as claimed in any one of claims 1 to 7, further comprising adding an uncoupler of ATP synthase from the photosynthetic electron transport chain.

9. A process as claimed in claim 8 wherein the uncoupler is selected from the group consisting of Carbonyl cyanide 3-chloro-phenylhydrazone (CCCP), 1,3-Dicyclo-hexylcarbodiimide (DCC), Ammonium chloride, Venturicidin, carbonyl cyanide *p*-trifluoromethoxyphenylhydrazone (FCCP), 2,4-dinitrophenol, Gramicidin and Nigericin.

10. A process as claimed in any one of claims 1 to 9 wherein activity of a mitochrondrial transcription factor which regulates the respiratory electron transfer chain is reduced or eliminated.

11. A process as claimed in claim 10, wherein the mitochrondrial transcription factor is MOC1.

12. A process as claimed in claim 10 or 11 wherein activity of the mitochrondrial transcription factor is reduced or eliminated through introduction of an antisense molecule, using RNAi, through introduction of an inactivating mutation, or introducing an inhibitor of the mitochondrial transcription factor.

13. A process as claimed in any one of claims 1 to 12 wherein cytochrome oxidase (complex IV) is downregulated.

14. A process as claimed in claim 13 wherein levels of the *cox1* transcript are reduced relative to *nad2*.

15. A process as claimed in any one of claims 1 to 14 wherein cyclic electron transport in the chloroplast is inhibited.

16. A process as claimed in any one of claims 1 to 14, wherein the microorganism is an alga or cyanobacterium.

17. A process as claimed in claim 16 wherein the alga is one of the green algae.

18. A process as claimed in claim 16 wherein the alga is selected from the group consisting of algae of *Synechococcus sp.*, the *Chlorococcales* and *Volvocales especially* those of *Chlamydomonas spp.*, *Scenedesmus spp* and *Chlorococcum spp.*, *Chlorella spp.*, *Platymonas spp and Trichomonas spp.*

19. A process as claimed in claim 18 wherein the alga is from the Order *Volvocales*.

20. A process as claimed in claim 19 wherein the alga is of Chlamydomonas spp.

21. A process as claimed in claim 20, wherein the alga is *Chlamydomonas reinhardtii*.

22. A process as claimed in claim 21, wherein the alga is *Chlamydomonas reinhardtii Stm6* deposited with the Culture Collection of Algae and Protozoa (CCAP) on 1 July 2003 under accession number 11/129).

23. A process for the enhancement of biomass production comprising the steps of:

(i) providing a photosynthetic microorganism having electron transfer capability through a photosynthetic "light" reaction pathway and through a respiratory electron transfer chain involving an oxidative phosphorylation pathway, and which expresses a hydrogenase, wherein regulation of the oxidative phosphorylation pathway is disrupted with the result that

electron flow along the respiratory electron transfer chain toward cytochrome oxidase (complex IV) is reduced;

(ii) culturing the microorganism under illuminated conditions and in the presence of a carbon source in order to expand the biomass.

24. A process as claimed in claim 23, further comprising gasifying the expanded biomass to produce hydrogen.

25. A process for sequestering carbon from an external nutrient supply, comprising the steps of:

(i) providing a photosynthetic microorganism having electron transfer capability through a photosynthetic "light" reaction involving photosystems I and II (PS I and II) and which expresses a hydrogenase, wherein regulation of oxidative phosphorylation is disrupted so as to reduce or eliminate inherent oxygen inhibition of the hydrogenase;

(ii) culturing the microorganism under illuminated conditions in order to expand biomass;

wherein the external nutrient supply is employed as a carbon source for said culture and so is depleted of carbon.

26. A process as claimed in claim 25 wherein the external nutrient supply is a waste stream.

27. A substantially pure culture of a photosynthetic microorganism having electron transfer capability through a photosynthetic "light" reaction and through a respiratory electron transfer chain involving an oxidative phosphorylation pathway, and which expresses a hydrogenase, wherein regulation of the oxidative phosphorylation pathway is disrupted with the result that electron flow along the respiratory electron transfer chain toward cytochrome oxidase (complex IV) is reduced.

28. *Chlamydomonas reinhardtii Stm6* deposited with the Culture Collection of Algae and Protozoa (CCAP) on 1 July 2003 under CCAP accession number 11/129.